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AGRICULTURAL JOURNAL

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DEPARTMENT OF AGRICULTURE, FIJI.

VOL. 4.] SECOND QUARTER, 1931. [NO. 2.

EDITORIAL.

CITRUS EXPORTS.

ATTENTION has been paid to the possibilities of increasing the citrus export industry and thus securing higher returns to producers. Oranges and mandarins have figured amongst the minor exports from Fiji for many years, but no proper attention seems to have been paid to the conduct of the business, either by the grower or the shipper. The increasing competition which Fiji has to meet in the New Zealand markets from other Islands of the South Seas should of itself provide a sufficient incentive to those engaged in the fruit export industry of Fiji to take every possible step to see that their fruit is of the highest quality and that it reaches the market in sound and attractive condition. Results of investigations made during the past season are recorded in this issue. They indicate a very real need for the adoption of improved methods of picking, handling and packing of citrus fruit for export and show clearly that increased returns will be obtained by the exercise of proper care at all stages. It does not appear to be generally realised in Fiji that fruit of this nature should be handled as carefully as eggs and that bruises and other forms of skin damage result in fruit rots which completely spoil the fruit for marketing. The methods normally used here result in a very high degree of wastage which causes heavy losses to all concerned. To maintain and develop this important side-line it is essential that standard methods be adopted without delay.

Since the article in this number was written, information has been received from Mr. A. L. Armstrong in regard to one case of mandarins which was sent to him through the firm of Messrs. Turners & Growers Ltd., Auckland. Owing to various causes the fruit was not delivered for a period of five weeks after its arrival and during this time it was lept in cool storage. On opening the case the contents were found to be in excellent condition and only three out of a total of 100 were uneatable. The remainder were of a uniform golden colour and quite firm. The fruit was juicy, not shrunken, and generally quite sweet, although a few were slightly acid. This interesting record emphasises the excellent carrying and keeping qualities of Fiji mandarins when they are handled and packed in a proper manner.

COPRA.

Copra prices continue to be low, although signs of improvement in the market are evident. The necessity for reducing production costs and improving the quality of the product by the practice of better methods of preparation is more evident during times such as these than, perhaps, when the demand for copra is good and prices high. In an article published in this number an endeavour has been made to outline the history of attempts to introduce copra grading in Fiji and to urge the desirability of the early

introduction of such a system. It is desired to place on record a note of appreciation of the valuable help and advice received from the Imperial Institute, London, and from the London Copra Association, as well as for the keen and active interest taken in this subject by the Coconut Planters' Union Ltd. of Fiji.

RAT CONTROL.

Investigations into this important problem have been continued and correspondence with the Imperial Institute, London, is now published for the information of those interested. The peculiar nature of the greatest difficulty attendant upon any scheme for rat control in coconut plantations in Fiji —the habit of the rodents which in many instances live permanently in the trees—makes a satisfactory solution much more difficult. It is clear that no reliance can be placed on viruses, which are indeed definitely condemned by many authorities; not only because of their limited success, but of the danger to the health of man. It appears that rats are the cause of considerable damage in pineapple plantations. In such cases the use of baits containing red squill powder should be found effective. In addition to the use of thin zinc sheets nailed round the trunk of the trees, the possibility of employing a band of tanglefoot mixture in a similar manner has been suggested as a possible control in coconut plantations. Observers, however, state that in some parts of the Colony the rats rarely, if ever, descend from the trees. In one instance where a coconut tree was cut down, no less than 80 rats, which endeavoured to escape from the crown, were killed. It seems clear, therefore, that in addition to other methods some means of laying poison baits in the crown will have to be found. The question continues to receive close attention.

AGRICULTURAL CONFERENCE.

It has been decided to hold an Agricultural Conference again during Show Week in Suva. By the courtesy of the Municipal Council the Town Hall has been made available for this purpose. It is proposed to open the proceedings at 2.15 p.m. on Tuesday, 13th October, 1931, when it is hoped that His Excellency the Governor will preside and address the Conference. The Organising Committee has decided that the following subjects will be dealt with at the Conference:—" The Citrus Export Industry "; " Production and Marketing of Supplementary Crops "; " The Stock Industry with reference to the Export of Chilled Beef "; " Some Problems of the Banana Industry "; and " The Pineapple Industry." Gentlemen prominently connected with these aspects of agriculture have been asked to deliver addresses, after which the subjects will be open for general discussion. Notices giving full details of the Conference arrangements will be published in the local press.

The Committee formed for the purpose of organising an Agricultural Convention has continued its inquiries and approved of draft rules for submission to the first meeting which it is hoped to hold during Show Week in conjunction with the Conference. The proposals are briefly, that the Convention should be a central body representative of the various Agricultural and allied Associations in the Colony, each of which would appoint two members to the Convention. The object is to provide a central authoritative body which can advise Government on agricultural matters raised by the various participating Associations and, generally to help the development of agriculture in the country districts of the Colony. The various Progress and other Associations in Fiji are being communicated with and it is hoped that they will all approve of the formation of this Convention and agree to become participating bodies.

CITRUS EXPORTS—EXPERIMENTAL SHIPMENTS.

By A. C. BARNES, Director of Agriculture.

THE citrus industry of Fiji is worthy of more careful attention on the part of both growers and exporters than it has hitherto received. Though there are no citrus plantations of any note in the Colony there are numerous blocks each of a few trees which yield excellent fruit, and which, if cared for, would become a profitable source of income to owners. At least one person recognises the possibility of establishing a plantation of trees of selected varieties of oranges and grapefruit. In the Sigatoka district a small area has already been planted and gives promise of returning a profit to the owner.

2. Citrus fruits, that is to say, oranges and mandarins, have long formed an important section of the minor produce exports of the Colony, but the business has been badly organised, and carried on with almost an entire neglect of the most elementary precautions necessary to ensure that the fruit reaches the market in a saleable condition. That any market at all exists indicates that the fruit is of good flavour and of inherent qualities which commend it to the consumer.

3. The markets available to Fiji are good. The fruit can be exported at a time when Californian, Australian, Tahitian and Norfolk Island oranges are unobtainable. With the exercise of care during all the stages of harvesting and preparation for the market, the fruit of Fiji can command a pre-eminent position in the market of New Zealand during April and May, and in Vancouver during May, June and July.

4. It is, perhaps, unfortunate that the need for attention to this valuable asset should have come to the fore at a time of difficulty which has faced the major industries of the Colony. Unfortunate in so far that the very difficulty of low market prices may deter many from giving the attention to a commodity which has hitherto been regarded purely as a side-line, almost but not quite unworthy of serious attention.

5. Nothing beyond the most cursory examination is necessary to point out the faults of present methods of handling the citrus crop. The fruit is dashed from the trees, thrown into boxes and transported to Suva, where much to the annoyance of the exporter it has to undergo a quarantine of seven days in fly-proof storage, after which it is examined, culled and "packed" under Government supervision. Though the rejection of fruit showing signs of fruit-fly is ruthless, the packing is in most instances nothing more than throwing the fruit into banana cases, and nailing down the lids. The amusement of those in other countries who regard the citrus export business seriously and who take every precaution to ensure that their fruit reaches the market in prime condition can be imagined!

6. From the moment the fruit leaves the tree in Fiji to the time it reaches the consumer it is exposed to every possible form of mal-treatment and the wonder is that any reaches the market in eatable condition. As it is, the losses are heavy and the financial returns far lower than the industry should command.

7. The existence of a small plantation of Mediterranean varieties of orange and of mandarins at Nasinu made it possible to secure sufficient supplies of fruit under control conditions to make experimental shipments to New Zealand during the season which has just closed. The area in question had been neglected for some nine years and late in 1929 the dense undergrowth was cleared, the land cultivated and the trees pruned of superabundant growth. A small crop was obtained in 1930 but it was not until this year that the trees attained anything approaching normal bearing.

As it was the fruit during its early stages of development suffered from the strong winds and storms of November, 1930, and February–March, 1931. The trees survived the severe buffeting in a wonderful manner and most of the fruit was of excellent quality.

8. Although it can hardly be claimed that standard modern methods were adopted for the harvesting and handling of the fruit, every care was taken to ensure that the minimum of damage occurred from the time of removal from the tree until it reached the consuming market. The fruit was cut with a portion of the stalk attached and a second cut was given after the removal from the tree so that the stalk did not protrude beyond the button. Harvesting took place during dry weather and commenced about the middle of the morning when the surface of the fruit was free from surplus moisture. The oranges were loosely packed in banana cases and immediately transported to Suva by lorry. The danger of bruising during transport was reduced as far as possible by placing the boxes on a thick layer of grass and the driver was instructed to proceed slowly over rough portions of the road.

9. On arrival at Suva the cases were stacked clear of the floor and with ample ventilation space between them in a small well-ventilated concrete insectary where they underwent seven days' quarantine required by New Zealand regulations. During a portion of this time they were treated with ethylene gas in order to stimulate the development of the orange colour of the skin and so to enhance the appearance of the fruit. The method adopted was to introduce a charge of the gas giving a concentration of approximately one part in two thousand, the room being completely closed. After a period of four hours the room was ventilated by means of fans after the doors had been opened. Fly-proof screening was kept over all apertures so that the quarantine should not be in any way affected. Ventilation was continued for at least 12 hours, after which a further charge, followed by another ventilation was given. On the occasion of the first shipment three charges of gas were introduced, but for subsequent shipments two were found sufficient to give a satisfactory degree of colouring.

10. As no proper packing-house arrangements were available the culling and sizing of the fruit was carried on in as simple a manner as possible. All fruit exhibiting signs of fruit-fly, bruising, or skin damage were discarded and the remainder passed through a locally-constructed sizing machine which consisted of two tapering rollers set on a slant above a series of canvas bottomed shoots. The rollers were rotated in opposite directions, so that their surfaces travelled upwards and outwards, by means of an electric motor working through reduction pulleys. It was found that the machine was capable of sizing upwards of 50 cases of fruit per hour.

11. The fruits were then wrapped individually in white cap paper cut to the sizes required and packed in accordance with their sizes in cases of South African pattern. The arrangement of the fruits in the case was decided by their sizes and was carried on as indicated by packing diagrams which had been supplied from South Africa. The boxes used were made by Messrs. Marlows Limited of planed Kauvula timber. The wood was unseasoned and the cases were therefore piled with ample ventilation between them in an open shed for a few days before they were used. They were constructed as nearly as possible to the specification set out on page eight of the *Agricultural Journal* No. 1 of 1930, except that no cleats were used. Cases for mandarins were of 26 in. by 12 in. and 4½ in. deep outside measurement. Each case was branded with a Fijian head in black and marked in red with the number of fruits it contained.

12. Four shipments of fruit were made in all comprising oranges and mandarins from Nasinu, a small quantity of limes from Beqa and seedless limes and oranges from Taveuni. Details of two of these shipments will be found in the appendix.

13. The shipment of May 5th comprised ten cases of oranges and one case of limes. The market report stated that the shipment was a vast improvement on the bulk of oranges sent from Fiji. The price realised averaged approximately 4s. per case more than ordinary lines. In this connection it should be noted that the cases used were of smaller capacity than those normally employed, so that the difference in price was even greater than 4s. in favour of the Departmental consignment. In regard to the limes it was stated that there was no great demand, but a small trade of from 20 to 50 cases a month throughout the year could be worked up. The gross return in respect of the oranges was £8 7s. 3d., an average of 16s. 8·7d. per case, from which must be deducted transport, packing, freight, commission, wharfage and cartage, amounting to 7s. 8d. per case, leaving a nett return at the plantation of 9s. per case. The average number of fruit per case was 207.

14. Fourteen cases of oranges treated in a similar manner were shipped on May 23rd. Results from this consignment were disappointing owing to the fact that it arrived immediately after a very large shipment from Rarotonga. The return after paying freight, wharfage, cartage and commission was only £1 11s. 7d. out of which the cost of cases, transport and packing had to be met.

15. On the 4th June, 27 cases of mandarins were forwarded to Auckland. The number of fruits per case varied from 64 to 120 according to the size. The cases used were as described in paragraph 11. The consignees reported that the condition of the fruit was excellent, as was also the colour and quality. They said that the market was not strong owing to the arrival of large quantities of Australian fruit which was being sold at low prices. The returns, however, were excellent. The fruit sold at prices ranging from 8s. to 12s. 6d. per case. The total amount realised was £13 19s. 6d., an average gross return of 9s. 7·6d. per case. Transport, cases, freight, wharfage and commission cost 4s. 6·74d. per case giving a nett return averaging 5s. 0·84d. per case on the plantation. The average number of fruit per case was 88, so that the value of the fruit on the plantation after removal from the trees was ·7d. each.

16. The final shipment was made on the 12th June and consisted of nine cases of oranges and two cases of seedless limes from Taveuni, with four cases of oranges and 18 cases of mandarins from Nasinu. The Firm to whom these were consigned reported that the oranges had been perfectly packed, but that the fruit had been somewhat spoiled in fumigation. The prices obtained were low owing to the simultaneous arrival of Cook Island fruit. The mandarins arrived in good order but again the market was overstocked owing to heavy consignments arriving from Sydney. The consignees stated that the fruit itself compared favourably with Australian fruit and would bring remunerative prices if it could be placed on the market earlier in the season. This statement was supported by the returns for the former shipment of mandarins already referred to. The report said that the demand for limes is assured as soon as the fruit becomes better known.

17. In spite of the depressing tone of the report the account sales were quite satisfactory considering the season and the condition of the oranges.

These were known to have been left on the trees rather too long and this fact, coupled with the time that elapsed between harvesting and shipment, would fully account for the statement that they appeared to have been spoiled during fumigation. The object was to test the possibility of profitable marketing of fruit from more distant parts of the Group and the trial indicated clearly that in future seasons earlier harvesting combined with careful handling and packing would ensure profitable returns.

18. The gross return for the nine cases of oranges was £4 4s., an average of 9s. 4d. per case. Freight, Suva–Auckland, commission, &c., cost 35s. 4d., and cases 15s., while freight, Taveuni–Suva, was 12s. 9d. Other costs amounting to 4s. 10d. were incurred for cartage from Suva wharf to the packing-shed and return and for wrapping paper, of which 3s. 3d. would have been saved had it not been necessary to quarantine, size and pack at Suva. The total charges were £3 7s. 4d., leaving a balance of 16s. 8d for nine cases on the plantation, or 19s. 11d. were the avoidable Suva charges omitted. Under normal circumstances the freight from Taveuni for a commercial consignment would have been less and the cost of extra handling in Suva unnecessary. The net return on the plantation in Taveuni for limes was 11s. 10d. for two cases.

19. From a commercial point of view such a small shipment would be unattractive to the producer, but the trial demonstrated that fruit of this class could be successfully exported from more distant parts of the Group, if proper arrangements for quarantine and packing were made at or near the districts where it was grown.

20. The oranges and mandarins grown at Nasinu and exported on this occasion gave better returns because of the lower internal charges, and though the result was not so satisfactory as with earlier shipments, oranges returned an average of 3s. 3d. per case and mandarins 1s. 8d. per case at the plantation. Oranges averaged 237 fruits per case and mandarins 103.

21. During the period covered by these trials, correspondence regarding the quality of Fiji citrus fruit passed between the Department and the Auckland Fruit Importers' Association. The latter organisation called attention to the shipment of sour fruit from Fiji and remarked on the low prices obtained for it. It was pointed out that oranges from the Cook Islands were required to conform to a standard sugar content.

22. This aspect of the citrus export business is one which receives attention in most countries where the fruit is grown. It is to the interest of the grower and exporter to ensure that fruit is of marketable quality, or in other words of the nature substance and quality demanded by the purchaser. The desire to get fruit on to the New Zealand market early in the season has encouraged those engaged in the trade in Fiji to ship immature fruit, whereby they have in many cases spoiled their market for consignments of better quality.

23. It is possible by a simple test to ascertain whether oranges are sufficiently ripe, that is whether the juice contains the proportion of sugar to acid which commends the flavour to the consumer. To endeavour to foist fruit which is not of prime quality on the market is to say the least unwise; but the practice has in the past been not uncommon and regulations have been introduced in other countries to prevent it. In Australia the danger is realised and in recent recommendations of the Citrus Preservaton Committee (2) it is stated that " the harmful effect on the trade would be very great if sour or immature oranges were included."

24. The trial shipments of the past season have indicated that a good seasonal market exists in New Zealand for properly packed Fiji oranges and mandarins of good quality. It appears risky to ship to New Zealand after the middle of May owing to the supplies of fruit forthcoming from other South Pacific Islands, but from that time to the end of the Fiji season there appear to to be good prospects of profitable marketing in Vancouver. Fiji fruit of excellent quality could be placed in that market before Australian supplies begin to arrive. Enquiries are being pursued in Vancouver with the object of arranging trial shipments in 1932.

25. The trials demonstrated forcibly that there is a keen demand in New Zealand for citrus fruit of good quality, attractively packed and that proper attention to the handling of the citrus crop of Fiji would lead to profitable returns. The conditions imposed by New Zealand render it necessary, as has been pointed out, to keep the fruit in fly-proof quarantine for a period of seven days prior to shipment. Not only is any attack of fruit-fly evident after this period but skin damage occasioned by rough handling shows up distinctly. Were it not for the fact that the time elapsing between shipment and consumption is short, little if any of the Fiji citrus fruit would reach its market in consumable condition. As it is the wastage is abnormally high and the price correspondingly low.

26. The most convenient spot to impose the quarantine is near the Suva wharf and it would be a simple and comparatively inexpensive matter to provide equipment for the sizing, wrapping and packing at that point. The additional expense to shippers would be small as the only extras involved are the cost of the wrapping paper, a little additional labour for proper packing, and a small extra charge for cases of better quality. As it is the whole of the fruit has to be inspected individually at the expiration of the quarantine period and packed under Government supervision. Very little organisation would be necessary to provide for sizing, wrapping and packing by standard methods.

27. So far, then, as arrangements at the port of shipment are concerned the problem is simple of solution, but more difficulty will be experienced in securing the necessary degree of care in harvesting and transport to Suva. These difficulties, however, must be overcome if the industry is to become prosperous and exporters must co-operate with producers to ensure that the necessary care is taken at all stages of the handling of the crop. The cost of the clippers required for harvesting the fruit is small and growers can themselves construct pyramidal ladders for use during harvesting operations in order to avoid damage to the trees. Picking bags are used in many countries, but in Australia the use of a packing-box of a capacity of about half a bushel is recommended. The box should be well padded inside and fitted with straps for hanging across the shoulders.

28. Quoting from recommendations by the Citrus Preservation Committee (2):—

(vii) Care should be taken to see that the fruit is not dropped, but transferred from one receptacle to another with the same care as would be given to eggs. If any orange is accidentally dropped or mishandled in any way during the operation, it should be immediately rejected, as otherwise it may be the means of ruining a whole case of fruit.

(viii) The most suitable type of field box is the box used in the canning industry, namely, a kerosene case cut open on the side with cleats nailed to each end for ease of handling. (Locally, the

ordinary banana case forms a suitable field box and has the additional advantage of being suitable for the carriage of the fruit to Suva).

(ix) Care should be taken to see that the field boxes have no inner surface projections of any kind; there should be no nails, protrusions of wood or sharp knot holes, all of which are liable to cause injury to the rind.

29. During transport from the place where the fruit is grown to Suva every care must be taken to avoid shaking the boxes and thus damaging the fruit. At no stage should they be roughly handled. The little extra care will ensure that the oranges are not bruised and will result in considerably less wastage.

30. In countries where the citrus export industry is highly organised even more care is taken than has been indicated in the foregoing remarks. Gloves are required to be worn during the operations of harvesting and packing as it has been found that the slightest scratching on the skin, particularly that caused by the finger nail of a worker, gives rise to infection which results in rotting and loss of fruit. It is however, possible to introduce simple methods which can be gradually developed to that pitch of efficiency which will place Fiji in the position it deserves as a citrus exporting country. It is necessary that all interested in the industry should work together and obey closely any instructions or regulations which may be issued.

APPENDIX.

DETAILS OF SHIPMENTS.

1—SHIPMENT OF MAY 6TH, 1931.

Total—10 cases oranges, 1 case limes.

No. of cases.	*Size.*	*Average diameter. (inches.)*	*Number of fruits per case.*
1	2	2½	252
2	3	2-9/16	226
4	4	2¾	200
1	5	2 7/8	176
1	Mixed 2 & 3	2½ & 3	232
1	Mixed	..	165

Account Sales—Oranges.

1 at 18/9	.. ..	£0	18 9
1 at 17/6	.. ..	0	17 6
1 at 16/-	.. ..	0	16 0
2 at 15/-	.. ..	1	10 0
5 at 17/-	.. ..	4	5 0
		£8	7 3

Average gross return per case oranges .. 16s. 8·7d.

Charges per Case.

	s.	d.
Cost of case	1	8
Cartage from Nasinu to Suva	1	4·35
Cartage store to wharf ..	0	2·18
Freight	2	10
Wharfage & cartage Auckland	0	5
Commission	1	3
		7s. 8·53d.

Net return at plantation £0 9 0

Note.—Cost of wrapping and packing excluded.

Limes.

Gross return	£0 15 0
Charges	0 7 8·5
Net proceeds ..	£0 7 3·5

2—Shipment of 4th June, 1931.

27 cases Mandarins.

Serial No.	No. of cases.	No. of fruits per case.	Price per case.	Amount.
1	1	120	£0 12 6	£0 12 6
2	10	100	0 11 0	5 10 0
3	2	90	0 10 6	1 1 0
4	12	80	0 10 0	6 0 0
5	2	64	0 8 0	0 16 0
..	27	..	....	£13 19 6

Average gross return per case .. 10s. 4·22d.

Charges per case.

	s.	d.	
Cost of case	1	0	
Cartage	0	6·84	
Freight, wharfage and cartage	2	3·3	
Commission	0	9·22	
			4s. 7·36d.

Net return per case .. 5s. 8·86d.

Note.—Cost of packing and wrapping excluded.

REFERENCES.

1. " Fruit Production for Export, Part I, Citrus Fruits," *Agricultural Journal*, Fiji, Vol. 3, No. 1.
2. *Journal of the Council for Scientific and Industrial Research*, Australia, Vol. 4, No. 2, p. 96.

CITRUS FRUIT PESTS.

By H. W. Simmonds, Government Entomologist.

In the tropics, citrus fruits are normally ripe before changing to a yellow colour; the presence of yellow fruit amongst the green in Fiji can be generally taken to denote insect disease. This may be due to either of the following causes:—

(1) *Fruit-fly* (*Dacus passifloræ*).—This is a black fly, about the size of a house fly and having a yellow scutellum (hind portion of the thorax).

The adult fly punctures the skin of the orange, grapefruit or mandarin and lays several eggs in the puncture thus formed. When these hatch the maggots bore into the tissues of the fruit, which break down and ferment. When the maggots are full-fed they leave the fruit, either before or after it has fallen, and enter the ground to pupate. Such fallen fruit is generally attacked by a number of other insects such as *Drosophila* (ripe-rot flies) and certain beetles, but these are not the primary cause of the rots.

This fly also attacks many other fruits, being particularly abundant in Guava, Kavika and Grenadilla, whilst it is also recorded from Ivi nuts, Sandalwood seed, Pawpaw and cotton bolls. It has not been found in limes or rough lemons.

Until commercial orchards are established in Fiji little can be done in the way of control. In order to prevent infected fruit being exported all oranges, mandarins and grapefruit are held in quarantine by the Department of Agriculture for a period of seven days. At the end of this time the fruit

is carefully gone over and repacked, when it is generally possible to detect the infected fruits and discard them. This detection of the breakdown of the tissues is more difficult in thick skinned grapefruits and in loose skinned mandarins, the skin of which does not come into close contact with the diseased tissues. For this reason planters, contemplating an export business, should only grow grafted fruit and should select a tight skinned variety for this purpose.

When commercial orchards are established it will be possible to do much to reduce the incidence of this pest:—

(*a*) by the *prompt* collection and destruction of all fruits showing signs of attack;

(*b*) by destroying any trees in the neighbourhood which act as a "carry over" for the fly between the citrus cropping seasons;

(*c*) it is probable that poison baits or sprays will also be found useful, but this will only be so when the trees are grown under orchard conditions.

(2) *Fruit piercing moth Ophideres fullonica.*—Much of the damage erroneously assigned to fruit-fly is really due to punctures made by an adult moth, *Ophideres fullonica*. This moth is capable of piercing the skin of ripe oranges, bananas, &c., and feeding upon the juice. The breakdown, thus caused, shows as a circular spot, generally about half an inch in diameter as contrasted to the irregular breakdown of the fruit-fly rot. In both cases the fruit yellows prematurely, generally with an orange tint and falls to the ground. There was an enormous amount of damage due to this moth this year on Taveuni.

The adult moth has an expanse of wings of nearly four inches, the front pair being beautifully marbled in greenish brown whilst the hind wings (only visible in flight) are bright yellow banded black.

The larva of the moth is a most striking creature, velvety black with white, red and blue markings and feeds upon the *Drala* tree (*Erythrina* s.p.).

Control.—This is difficult. Destruction of all *Erythrina* trees in the district is essential. The moth occurs everywhere to India and should commercial orchards be established it might be possible to obtain some additional biological control to that already present in the country. In South Africa similar damage is done by different species of moths and the following method, recommended by Brain, should also be suitable for Fiji:—

(*a*) 1½ oz. arsenate of lead powder, 53 oz. (⅓ gall.) treacle, 4 gallons water; or

(*b*) ½ oz. arsenate of soda, 53 oz. (⅓ gall.) treacle, 4 gallons water.

Kerosene tins are partly filled with ripe fruit juice and some of one of the above poison mixtures is poured over them. A tin is then hung under every fifth or sixth fruit tree. If a ripe orange is cut in half and placed on the mixture, pulp side up, it is more attractive. Add to the mixture as it evaporates, and remove dead moths.

Mites.—In the Cook Islands, but much less frequently in Fiji, oranges in ripening assume a brownish scabbed appearance. This is due to attacks by a mite (*Eriophyes* (*Phytoptus*) *oleivorus*). Such fruit is generally very sweet and in the New Zealand market frequently selected for this reason.

A METHOD OF CONTROL FOR BANANA BORER (*Cosmopolites sordidus*).

By H. W. SIMMONDS, Government Entomologist.

FOR many years entomologists in various parts of the tropics have given much thought and work in an endeavour to discover some method of controlling this beetle, but with little success, the use of the soil fumigant paradichlorobenzine, being the only method showing promise of practical result.

In Fiji some measure of success has been attained by biological methods. The predatory beetle *Plæsius javanus*, introduced in 1913 by Jepson, has become thoroughly established and is undoubtedly doing good.

Nevertheless, the borer remained the most serious of the banana problems in this country as it was established in all parts of the Group and it was impossible to adopt the method used in some portions of the world of obtaining clean plants from non-infected areas for planting-up purposes.

Experiments carried out by this Department showed that, whilst flight undoubtedly occasionally occurred, it was not frequent and was negligible as a means of spreading the pest. It was also found that spreading by crawling was not nearly so rapid as is usually thought to be the case and that clean plants placed beside plants rotten with borer would frequently remain clean at the end of twelve months.

The efforts of the Government Entomologist were therefore concentrated upon devising a means of obtaining clean suckers for planting purposes, as it was felt that if clean plants were used on clean land it would be so long before these plants became severely affected that the grower would be enabled to take his crop and make his profit before this happened. In the efforts to attain this object a considerable measure of success has been attained.

Method of attack and effect of the banana borer.—The banana borer (*Cosmopolites sordidus*) lays its eggs just inside the corm of the plant, about the level of the surface of the soil, the eggs being thus most difficult to discover. These eggs hatch within about ten days and the resulting grub bores into the interior of the corm which is often completely tunnelled and rotten with the borings. When the grub is full-fed it approaches the surface of the corm, still remaining inside, where it pupates and, upon completion of its metamorphosis, eats its way out.

The effects of these attacks are twofold—

(1) A considerably reduced bunch of fruit, the plant producing only six or eight hands instead of the proper ten or twelve;

(2) a greatly shortened life to the estate, which gives the appearance of being worked out after 2½ or 3 years, instead of lasting in full bearing for five or seven years.

Control.—As the insect lives throughout its earlier stages within the tissues of the corm, with only the minutest connection with the outside air, ordinary fumigating processes are useless. It was, however, thought that the fumigant might be carried into the tunnels by means of a vacuum and tests were carried out, using carbon-di-sulphide as the poison. Some measure of success was attained, but some of the full-fed larvæ and pupæ survived to a point where the plant was killed and it is doubtful if the eggs were affected.

Experiments were then carried out with prolonged soaking and the desired 100 per cent. mortality of borer and eggs was attained by the following method:—

DIRECTIONS.

(1) Good strong suckers must be selected, having one or more undeveloped lateral eyes in addition to the aerial stem.

(2) These suckers are placed in a tub, punt or other water-tight vessel, with the aerial stem upwards.

(3) They are then covered with fresh water to a depth of about two inches above the point where the stem joins the corm, leaving the aerial stem fully exposed to the air and light.

(4) They are left for 21 days, taking care that the water is maintained during the whole of that period at the same level. This is most important.

(5) After 21 days they are removed and planted out, either in an isolated nursery or in the field.

It will then be found that they die back to the corm and one of the lateral eyes develops, producing in 12 months a bigger and better bunch than would have been the result had the sucker itself grown.

Planters are strongly urged to adopt the above methods either individually or collectively by making nurseries and distributing the resulting plants.

RAT CONTROL IN COCONUT PLANTATIONS.

425/31. Department of Agriculture, Suva, Fiji,
9th March, 1931.

Dear Sir,

I have the honour to seek your co-operation and assistance in dealing with the serious local problem of rat control in coconut plantations. The depredations of the rat are by no means confined to coconuts, but in Fiji it is found that its effect is most marked in relation to copra production and that the annual loss is of the order of 7 per cent. of the crop ("Early Nutfall from Coconut Palms in Fiji," by T. H. C. Taylor, B.Sc. (Lond.)).

2. The rodents live in the trees and appear to confine their activities to particular groups of trees in a plantation. Surridge has investigated the problem and has suggested remedial measures which are given in the Fiji *Agricultural Journal* No. 3 of 1930.

3. The use of a virus has been advocated and I observe that a new rat virus prepared by the Pasteur Institute, Paris, has been put on the market. Local opinions differ as to the advisability of introducing this or any other virus to Fiji. The Chief Medical Officer and the Senior Veterinary Officer do not support its introduction.

4. Attempts have been made to control the pest by predacious birds and animals. There are local owls which are said to feed their young exclusively on rats and something might be done to increase their numbers by providing special breeding places. This work could only be done by an expert.

5. The masked owl was imported from Tasmania in 1929, but owing to the sudden attack of those introduced upon young farm-yard birds as soon as they were liberated, the move was not popular, and nothing is known as yet of the effects of those eventually set free in a coconut plantation.

6. The mongoose was also introduced, with the object of controlling rats in sugar-cane areas, but local legislation prohibits its introduction to other islands in the Group and popular opinion is averse to any lifting of the ban.

7. There is an undoubted lack of co-operative effort on the part of owners of coconut plantations and the problem is a proper one for the Coconut Committee of Fiji to deal with on similar lines to the methods adopted for the control of disease and loss occasioned by insects. The Committee has given much attention to the matter, and at a later date may be able to engage a special officer to inaugurate an organised campaign in somewhat the same way as was done in Cyprus.

8. I should, therefore, be grateful for your advice on the following points:—

(*a*) the use of viruses; those recommended; objection, if any, to their employment;

(*b*) the possible introduction of other means of control than those already tried locally;

(*c*) the prospects of securing the services of an experienced man, capable of organising a rat-control campaign in Fiji.

9. I forward for your information copies of Departmental publications on the subject.

I have, &c.,

The Director, Imperial Institute,
Kensington, London, S.W.

DIRECTOR OF AGRICULTURE.

Imperial Institute, South Kensington, London, S.W. 7,
19th May, 1931.

Sir,

In reply to your letter 425/31 of 9th March I have pleasure in forwarding you the following information on rat destruction, with special reference to the points you have raised.

Rats do much damage to tree crops in many parts of the tropics, but as they do not usually live in the trees they can often be dealt with fairly effectively by well-known methods, such as the use of poisons and traps, and also by introducing carbon bisulphide, sulphur dioxide, &c., into their burrows.

The special difficulty due to the rats spending all or most of their time actually in the trees appears to be largely confined to your region of the world.

In Papua (see *Bulletin* No. 8 ,1918, of the Department of Agriculture) trouble resulting from this habit of life is reported. It was apparently not very serious at the date mentioned and poisoning with white arsenic proved usually satisfactory. The poison was dusted on the cut surfaces of sweet potatoes, ripe bananas, or sugar-cane joints, cut lengthwise and the parts skewered together again.

In Fanning Island, according to an inquiry received this year at the Imperial Institute, the problem is evidently very similar to yours. A great deal of damage is done by rats which seldom or never come to ground and no satisfactory method of dealing with them has yet been found.

In French Oceania rats inhabiting coconut palms are also a very serious pest. The most satisfactory method found there for preventing their

ravages has been banding the trees with sheet zinc. In *Bulletin des Matieres Grasses de l'Institut Colonial*, 1928, No. 4, 118–130, and 1929, No. 10, 316–17, an account is given of the action taken by the Government to arrange for the importation of very large numbers of sheets of zinc. Such work would of course have to be undertaken in a systematic manner, isolated blocks of trees being banded and then the rats dislodged from their crowns. By the use of zinc sheets the difficulty due to galvanized iron or tin bands becoming rusty, as mentioned in your *Agricultural Circular* V, No. 2, would be avoided.

You could doubtless obtain later information on the progress and success or otherwise of the scheme from the Chambre d'Agriculture des Etablissements Francais de l'Oceanie.

On the question of viruses the best authoritative opinion obtainable is definitely against their use.

I enclose copies of a letter, memorandum and leaflet received from the Ministry of Agriculture and Fisheries. In the first it is stated that " the Ministry does not recommend the use of virus preparations for rat destruction. Its attention has been drawn to the reported discovery of a new rat virus by the Pasteur Institute, but as a result of inquiries which have been made in connection therewith the Ministry can see no reason to depart from the opinion referred to in the leaflet."

The United States Department of Agriculture holds a similar view on the use of viruses, as indicated by the following extract from the new edition of their *Farmers' Bulletin* No. 1533 on " Rat Control " issued June, 1930:—

> " Rat viruses on the American market contain living organisms, or bacteria, known as the Danysz bacillus, which when ingested by rats is said to cause a disease that is followed by great mortality. In extensive experiments with rats conducted by bacteriologists of the Department of Agriculture, however, even the most virulent cultures failed to produce a high percentage of deaths, while the majority of the viruses tested were practically ineffective. Also the disease produced was found not to be contagious, except when one rat ate another. Thus there is little probability of the disease spreading to an appreciable extent. There also appears to be well-founded doubt as to the harmlessness of rat viruses. The Danysz bacillus belongs to the same group as the food poisoning bacilli and is indistinguishable from them. Although it has not been possible directly to trace many cases of human food poisoning to rat viruses, two State boards of health have prohibited their sale within the States. For these reasons the department does not recommend the use of viruses for the destruction of rats."

Your question in regard to securing the services of an experienced man capable of organizing a rat control campaign is answered in the enclosed letter from the Ministry of Agriculture. Application was made to the Ministry as the latter had arranged for the Cyprus Government to obtain the services of such an officer.

I am, &c.,

S. E. CHANDLER,
for the Director.

The Director of Agriculture,
Suva, Fiji.

MEMORANDUM ON THE USE OF VIRUSES FOR THE DESTRUCTION OF RATS.

(*Prepared by the Ministry of Agriculture and Fisheries.*)

1. It has been the consistent policy of the Ministry of Agriculture and Fisheries not to recognise officially the use of viruses consisting of cultures of microbes causing intestinal diseases for the destruction of rats and mice. The position is explained in the Ministry's Leaflet No. 244, page 7, a copy of which is attached.

In connection with the experiments conducted by the Zoological Society of London on behalf of this Ministry and the Ministry of Health in 1919 with a view to ascertaining the most successful means of combating rats and mice, preparations of viruses were also tried and the report on their use is as follows:—

"The discovery some time back of a bacillus pathogenic to rodents led to a new method for the destruction of rats and mice. Following this discovery, the virulence of the organism was raised by artificial methods in the laboratory and a number of rat viruses were placed on the market.

The manufacturers of these claimed that the bacillus was so virulent that it would kill rodents in about 10 days, and that within a month the disease would spread with fatal results to the whole of the rat (*or mouse*) population of the area under treatment. The results of recent investigation on the efficiency of some of the viruses on the market have been disappointing. Bainbridge has experimented on a very large number of rats in captivity, and the results of his experiments showed that the destructive power of all the viruses he tested was inconstant, the death-rate in the different experiments varying from 20 to 50 per cent. Further, according to this experimenter the presence of agglutinins in the serum of the rats which survived after being fed on virus gave reason to suppose that a certain proportion acquired immunity and were therefore unlikely to succumb to a second infection.

Experiments with the rat-viruses conducted some years ago during the outbreak of plague in San Francisco also gave poor results.

It must be recognised that, if generally successful, this method of exterminating rats and mice by spreading among them a disease, not affecting man and domestic animals, could not be improved upon, and I was therefore anxious to give a thorough test to all the viruses on the market in the hope that the results of the experiments under natural conditions would differ from those obtained in the laboratory.

In all seven tests were made with different virus preparations, and of these one only was an unqualified success; three were partial successes, a very slight reduction in the number of rats being recorded, and three were absolute failures. The experience of a number of reliable witnesses indicated that the successes in these cases amounted to about 33 per cent.

No further official tests have been made in this country but many reports have been received, most of which state that the results obtained by using viruses are disappointing. These may be due to conditions of temperature, immunity of rats and mice eating the baits containing the germ or to the viruses not being in a pathogenical condition owing to length of manufacture, weakness of the strain of bacillus used or contamination with moulds, or other germs. However, on the Continent a great deal of experience has been obtained.

According to Dr. Hans Wreschner in a report contained in the *Zeitschrift fur Hygiene und Infections Krankheiten*, 93 Vol., 1921, pp. 35–42, it was found that Danysz and ratin viruses, amongst others, were the cause of illnesses and deaths in human beings in Germany and Switzerland, and it is this official's opinion that such bacterial preparations should only be used away from human habitations owing to the potential danger to man and domestic animals.

In a report of June, 1924, by A. Moncke, a practical worker with viruses, it was stated that ratin had not been proved to be harmless to human beings, and that he had himself suffered from such an infection."

In the Annual Report of the Medical Officer of Health for the City of London for 1924 the following remarks were made:—

" In spite of the discouragement of its use by the Ministry of Agriculture and representations to the Government by the City Corporation, rat virus is still being largely used in many premises. The experiences gained in the City does not bear out the claim that rats and mice die in the open after being poisoned by virus, as complaints have been made of the nuisance of dead rats between match-boarding and walls and under floors in premises where virus has been used.

By a general Army Order, dated July 29th, 1919, the use of any vermin-destroying virus preparation is prohibited in all military establishment and camps, the reasons stated for their prohibition being (1) they are apt to produce a rat population which is immune to the action of the virus, (2) there is a certain degree of risk of food contamination, with resultant food-poisoning outbreaks.

Experience in the City has proved that both these reasons are sound. It is regrettable that the civilian population is not afforded the same protection from food poisoning outbreaks as that which the Military Authorities afford the Army by prohibiting the use of virus. It probably kills only 50 to 60 per cent. of the rats and should be condemned for that reason alone."

Some short time ago I drew the attention of a firm of food manufacturers in this country to the question of discontinuing the use of virus on their premises. They had obtained the virus from Holland, and the Ministry of Health in this country reported as follows:—

" The material yielded a profuse growth of *B. enteritidis* (Gaertner); this organism may be pathogenic for human beings and domestic animals.

This Department do not regard with favour the use of these viruses as they are attendant with a risk to human health.

The organism invariably employed is one of the food-poisoning group and infected rats recovering from the illness may retain these organisms in their intestines for long periods, with the possibility of contaminating human food with an infection which is highly pathogenic."

It is understood that the use of this virus has now been discontinued both in the English and the Dutch factories.

The following is an extract from the Annual Report for 1925 of the Surgeon-General of the U.S.A. dealing with plague suppressive measures in Oakland, California:—

" Moreover, the results of trappings are definite, whereas poisoning results are problematic. A biologic poison known as ratin was tried, but the opinion formed was that poisoning was of no great

value. Better results, however, were obtained with ratinin—a preparation of squill and it seemed evident that poisoning by squill was of distinct value.

At least two of the commercial firms engaged in marketing so-called " rat viruses " that are claimed to create an epizootic gastro-enteritis in rodent population, advocate and practice a system of double poisoning, the first by a virus and second by a chemical poison. It seems pertinent to suggest at this time that whatever values these systems possess is probably due to the chemical poison, not to the virus, and that the former could be used as effectively and much more cheaply under their correct designation rather than as a proprietary product."

2. The use of a virus on an extensive scale is undoubtedly much more expensive than the application of safe poisons or even dangerous poisons. If the circumstances permit, gassing is a comparatively cheap way of destroying rats, especially if labour is inexpensive. It is difficult to give exact figures, but some years ago a campaign was organized in the City of Birmingham and some hundreds of pounds were spent in applying Liverpool virus. A subsequent application of a bait containing barium carbonate was said to have been quite as, if not more, efficacious than the use of virus and the cost was many times less. A leaflet (D.R.I.) giving notes for the guidance of officers appointed to supervise measures for the destruction of rats and mice is attached.

The danger to domestic and undomestic animals has been briefly dealt with under 1. In this country and on the Continent rodents other than rats and mice have been affected by the use of viruses and it has been stated that the domestic animals have also suffered. Above all the use of a disease spreading rat poison should be only pathogenic to rats and mice. All preparations I have had to deal with hitherto do not conform to this standard. In addition immunity plays a dominant role in the question of destruction and nearly all makers of virus supplement their bacterial preparation with a secondary one, invariably a red squill preparation in order to obtain 100 per cent. kill. This is not logical, because if the secondary preparation is necessary to obtain 100 per cent. kill it should be used in the first instance as advocated by this Ministry and not to patch up the fallacies of the virus application. It must be admitted that if conditions are favourable and expense is no object the use of a virus will weaken the strain of rats and make them more susceptible to the use of a secondary preparation, but this is more a matter of theory than of practical rat destruction.

EXTRACT FROM " NATURE," APRIL 4, 1931, PAGE 532.

The value of red squill powder in the destruction of rats is becoming increasingly recognised. When experiments were carried out in the Zoological Gardens in London some years ago, it was found that the liquid preparation of red squill (a liliaceous plant known also as scilla and sea-onion, *Urginea maritima*) was more trustworthy than powder mixtures. Since 1923, however, the United States Department of Agriculture has been experimenting with the powdered forms, and it has been found that a powder of maximum toxicity can be obtained by drying the sliced bulbs at a constant temperature of 80 degrees C. Thus the greatest difficulty in the use of red squill, irregularity of results, has been overcome, and the poison has become the most widely used against rats in the United States. It is greatly in its favour that this rat poison is relatively harmless to human beings and

domestic animals; indeed, in field tests, prairie dogs and pocket gophers refused to eat the red squill baits, and in most cases cats, dogs, chickens, pigeons and pigs either refused to eat poisoned foods or, having eaten, promptly vomited them. One of the authors of the new United States Department of Agriculture *Leaflet* 65, " Red Squill Powder and Rat Control," himself swallowed 15-grain and 40-grain doses of a toxic red squill powder without untoward results.

GRADING OF COPRA FOR EXPORT.

Imperial Institute, London, S.W.7,
Sir, 6th March, 1931.

With further reference to your letter No. 1300/30 of the 15th August last and in continuation of my letter of the 3rd October regarding the grading of copra for export, I have to state that the questions involved have now been fully considered by our Advisory Committee on Oils and Oilseeds, in consultation with the London Copra Association and other exports, and I send herewith a memorandum summarising the various recommendations obtained.

If further steps are taken with a view to the grading of Fiji copra, the Imperial Institute will be glad to receive as suggested in the memorandum, experimental samples of the proposed grades for submission to trade experts. We shall also be glad to be of any further assistance which may be possible.

It was hoped to send you with this memorandum a set of samples representing the usual commercial grades of copra now on the London market, which were promised by one of the firms consulted. These have not yet been received however and the memorandum is now being forwarded without them in order to avoid further delay. The samples will be despatched to you immediately they are received.

I am, &c.,

The Director of Agriculture, Fiji. HAROLD BROWN,
for Director.

THE IMPROVEMENT AND GRADING OF FIJI COPRA FOR THE MARKET.

Grading.—It is considered that the grading of copra prior to export from Fiji should contribute towards the improvement of the quality of this product entering the world's market. In this connection it would be advisable to restrict the number of grades to two, the better of which would represent a quality intermediate between that of Straits and Ceylon copra. In the event of a decision to adopt grading, it is suggested that, before such grading is put into force, samples of the proposed grades should be forwarded to the Imperial Institute in order that the opinion of the trade may be obtained upon them.

Quality.—The following characteristics are considered in judging the value of copra:—

Size of pieces.—Large pieces are preferred by the trade. In small pieces the acidity of the oil tends to be higher. On the other hand, small pieces dry more rapidly and can be packed more compactly.

Thickness.—Thick copra is preferred to thin. Thinness suggests that the copra has been prepared from nuts which were under-ripe.

Colour.—The inner surface of copra should be as light-coloured as possible. It is more important, however, that the pieces internally (*i.e.*, on being cut through) should not show any discolouration.

Brittleness.—Many manufacturers prefer a brittle copra as they find such a copra gives a more satisfactory result on crushing. The drying should be controlled to prevent the copra from becoming horny through too rapid drying.

Mould and insect attack.—The presence of mould, especially of black mould, detracts from the value as does also damage by insect attack.

In the light of the above desiderata for copra of good quality, it would appear that the chief defect of the present Fiji product is its poor colour. This is possibly due to some extent, if not entirely, to lack of sufficient care in protecting the nuts from rain during the drying process or from damp during storage. Care should also be taken to use only ripe nuts, and these with advantage might be cut into quarters instead of into a large number of pieces. The drying should be so controlled that the products does not become horny or discoloured internally.

Increased price.—If the copra can be improved in quality, the best way to obtain an enhanced price for it would be to market it on type, *i.e.*, to sell consignments on sample and not merely as " Plantation Fiji " or Fiji Copra." Care would of course have to be taken in such case that the bulk consignment was equal in quality to the sample. When offered in this way there should be a greater chance of obtaining a premium over the market price of the Fiji copra at present exported. In general the minimum shipment of any new grade of copra should be from 100 to 200 tons.

If, however, the present method of marketing be followed in the case of an improved quality of Fiji copra, it is not likely that an enhanced price will be received immediately, but if the improvement is permanent and buyers become able to rely upon the maintenance of the quality, such copra may ultimately fetch a price slightly higher than that paid for the ordinary grade of Fiji copra. As was the case with Crown Estates Samoan copra (which is now selling at a slight premium) it would probably take several years for an improved grade from Fiji to receive this recognition in the market.

Conclusions.—The improvement of the quality of Fiji copra is desirable and may be effected by taking the precautions outlined above. If grading is adopted the number of grades should be restricted to two. If the quality is improved an enhanced price may eventually be obtained. Whether the increase in price will be justified by the increased cost of preparation can only be determined in Fiji but even if the increase is small the improvement in quality should lead ultimately to an extended demand for Fiji copra.

THE GRADING OF FIJI COPRA.

By A. C. Barnes, Director of Agriculture.

The question as to whether Fiji copra should be graded or not has been under consideration for several years. The subject was referred to in the Governor's Speech to Legislative Council on the 22nd November, 1926, and a Select Committee was appointed to consider a Draft Bill to raise the standard of copra produced in the Colony and to prevent the export of inferior copra. The report of this Committee was published as Council Paper No. 4 of 1927 which includes a memorandum from Sir Maynard Hedstrom and a

Draft Bill which, with amendments to be referred to later, was ultimately passed. This Bill in its original form included provisions for the compulsory grading of copra. The Committee's report was discussed at length by the Legislative Council on the 2nd June, 1927 (reference Fiji Legislative Council *Debates* 1927, pages 90–97).

2. A motion was approved for the introduction of a Bill at a subsequent session. The Bill was read for the first time on the 17th October, 1927, and the second reading was taken on the 24th October. During the debate His Excellency the Governor stated that it was proposed to amend the title of the Bill so that it would not refer in any way to a Bill to prevent the export of inferior copra from the Colony and indicated that the Bill as proposed to the Council would not interfere with the carrying on of the export trade of copra as it then existed. It was hoped that permissive instead of compulsory grading would provide the necessary incentive, both to Europeans and to natives, gradually to improve the quality of copra so that it might be graded officially as first or second grade copra.

3. The general effect of amendments to the original Bill which caused it to be presented to Council in modified form and of amendments made during its passage through Council altered completely the effect of the Bill in so far as grading of Fiji copra is concerned. Subsequent amendments passed at later sessions of Legislative Council did not improve in any way the position regarding grading nor did Proclamations under Section 15 apply the permissive grading sections to any part of the Colony so that they may be said to have exercised no effect whatsoever on the quality of Fiji copra.

4. The Coconut Planters' Union have at all times supported the proposal to grade Fiji copra and to establish definite standards of quality. Since May, 1930, they have renewed their efforts to secure the introduction of a workable system of export inspection and grading. As Director of Agriculture I have paid close attention to this matter since my arrival in the Colony and have taken steps to secure information from the Imperial Institute regarding comparative market prices of copra from different exporting countries as well as on copra grading and the standards of quality most likely to commend themselves to the market. In a letter dated 17th April, 1930, replying to a request from me, the Director of the Imperial Institute kindly offered to furnish such information as was available and to send at regular intervals copies of market reports from Messrs. L. M. Fischel & Co. Ltd. This correspondence was published in *Agricultural Journal* No. 2 of 1930, together with copies of remarks on copra and coconut oil published in the *Trade Review* on the oil and oil-seed markets during 1929.

5. His Excellency received a deputation of the Directors of the Coconut Planters' Union Ltd. on the 4th June, 1930. The Acting Colonial Secretary and myself were present. The deputation handed to His Excellency a copy of a circular letter which had been forwarded to all members of the Union, and shippers and other persons interested in the production and export of Fiji copra. Other papers presented were a letter from the Directors, copra market reports from Messrs. L. M. Fischel & Co. Ltd., and a reprint of an article on Fiji copra by Clive Joske. The object of the deputation was to bring to the notice of His Excellency the history of attempts to introduce copra grading, the objection to the principle of voluntary grading provided for in the Copra Ordinance 1927, and the desirability of making early provision for the compulsory grading of all copra exported from Fiji. The deputation urged that the London Copra Association should be consulted

and that if and when compulsory grading were introduced that Association should select a man for the post of Inspector and Grader.

6. His Excellency ordered me to make a record of the proceedings and to prepare a memorandum for the consideration of Executive Council. In the course of the discussion the Acting Colonial Secretary said that the system of permissive grading was introduced in order to give an opportunity of demonstrating the advantages of grading to native producers, but he agreed that as no grading had yet been done the time appeared now to be ripe to consider the introduction of compulsory grading.

7. Action has been continued during the period elapsing since the date of the interview, and communications have passed between myself, the Coconut Planters' Union Ltd. and the Imperial Institute, London. That correspondence may be summarised as follows:—

(*a*) Letter dated 18th June, 1930, from the Director of Agriculture to the Secretary, Coconut Planters' Union Ltd., Suva, referring to the interview between His Excellency the Governor and the deputation from the Union and asking them for forms of contract for copra approved by the London Copra Association, together with information regarding the characteristics which determine the relative market values of various grades of copra and the minimum shipments of high grade copra which would command prices in accordance with their quality. The desirability of reducing storage and transport costs was urged and it was pointed out that careful methods of preparation yielded not only a product of better value but a greater amount of copra from the same quantity of raw material. Reference was made to an article on mould damage to copra in *Agricultural Journal* No. 2 of 1930.

8.—(*b*) Letter from the Secretary, Coconut Planters' Union Ltd., dated 21st June, 1930, formally acknowledging (*a*).

9.—(*c*) Letter from the Coconut Planters' Union Ltd. to Director of Agriculture dated 3rd July, 1930, forwarding copies of two forms of contract upon which all copra sales take place in or through London and suggesting that the Imperial Institute communicate direct with the London Copra Association in regard to matters referred to in (*a*). A recent market circular from L. M. Fischel & Co. Ltd. was forwarded. It was stated that at least 25 per cent. of Fiji copra was now or could easily be made of F.M.S. Straits quality as most plantations of any size were equipped with driers.

10.—(*d*) Letter dated 15th August, 1930, from the Director of Agriculture to the Secretary, Coconut Planters' Union Ltd., acknowledging (*c*) and submitting suggestions for consideration regarding the possibility of producers of good quality copra shipping their copra under distinctive marks to Suva where inspection could be made and consignments officially branded for export. It was suggested that producers of high grade copra might be registered and required to maintain the standards of quality specified for grades decided upon as a condition of registration.

11.—(*e*) Letter from the Director of Agriculture to the Director of the Imperial Institute dated 15th August, 1930, asking for information in regard to copra grading and standards of quality. It was suggested that the Institute should communicate direct with the London Copra Association in regard to the characteristics as judged by cursory and superficial examination which determined the relative market value of various grades of copra and the minimum shipments of good quality copra which would command higher prices.

12.—(*f*) Letter from the Secretary, Coconut Planters' Union Ltd., to Director of Agriculture dated 29th August, 1930, stating that no practical

advantage was likely to be gained by the system suggested in (*d*). It was considered that unless the principle of grading were adopted by all in Fiji, few planters would attempt to grade their copra on the estates into what they considered to be export grades. The only point at which copra grading could usefully be mployed was at the port of export. It was essential that the system be a compulsory one; the salaries of the staff necessary might be provided by a levy on exported copra. Reference was made to co-operation by the Empire Marketing Board.

13.—(*g*) Letter from the Director of the Imperial Institute to Director of Agriculture dated 3rd October, 1930, acknowledging (*e*).

14.—(*h*) Letter from the Director of the Imperial Institute to Director of Agriculture dated 6th March, 1931, forwarding a memorandum on the matter of grading of Fiji copra for the market and referring to a set of samples representing the usual commercial grades of copra which would be despatched at a later date. The memorandum forms Appendix 1.* Copies of this letter and the memorandum were forwarded to the Directors of the Coconut Planters' Union Ltd. and to other gentlemen interested in copra production and export and their comments were invited.

15. On June 23rd, 1931, a deputation from the Coconut Planters' Union Ltd. was received by His Excellency the Governor when a memorandum was presented outlining a scheme for export copra grading. It was pointed out that the most powerful inducement to the production of first grade copra was some direct financial benefit and a graduated export tax on copra was proposed with provision for the payment of a bonus on first grade copra at the expense of the lower grades. The scheme was outlined in the memorandum as follows:—

(1) copra to be graded at Suva and Levuka by special graders appointed through the London Copra Association;
(2) no charge to be made for grading at Suva and Levuka (two principal export points);
(3) exporters to be free to ship from other ports ungraded, but to be allowed to make special arrangements for grading at outside ports at their own expense. (On somewhat parallel conditions to those upon which ships are permitted to take Customs officers from Suva or Levuka and load cargo at other than ports of entry);
(4) three grades of copra to be established with such names as "Fiji Plantation," "Fiji F.M.S.," and no name;
(5) no export tax to be levied on copra graded as "Fiji Plantation"; "Fiji F.M.S." to pay 1 per cent., or whatever is regarded as the normal rate of tax for the time being; the unnamed copra to pay double that tax;
(6) a bonus of 2s. 6d. per ton to be paid on all copra graded as "Fiji Plantation."

16. Messrs. L. M. Fischel & Co. Ltd's market reports have been received regularly from the Director of the Imperial Institute. In spite of the almost continuous fall in market prices to the beginning of June, 1931, those reports indicate that the higher values of Ceylon F.M.S. and Singapore F.M.S. continue to be a feature of the market. Under date 29th April, 1931, the market price of South Sea F.M.S. c.i.f. Northern European ports was £13 12s. 6d., prices for Ceylon and Singapore F.M.S. being £15 2s. 6d. and £14 2s. 6d. respectively.

17. Late in 1930 it was reported that San Francisco buyers had lost interest in copra shipped direct from Rotuma because of its inferior quality

* See pp. 70–71.

and that if early steps were not taken to deal with the situation Rotuman producers might find themselves without a market. A Firm of San Francisco importers stated definitely that their crushers were generally loath to contract for any Fiji sun-dried copra because of the extreme variation in the quality of the lots received.

18. The position now reached is that a strong body of opinion representative of producers in Fiji supports the introduction of a system of export grading of copra under marks which will indicate to the overseas purchaser the standard of quality of individual shipments. Consumers, that is to say, crushers, would welcome the opportunity of securing parcels of Fiji copra of certified quality. Local merchants in most cases, if not definitely antagonistic to export grading, appear not to be entirely in favour of it. Although merchants' interests must receive some consideration in connection with a problem of this nature it should be borne in mind that they act as the intermediary between the producer and the consumer and if both producer and consumer are in favour of compulsory fixation of standards of quality and export grading the merchants should be prepared to fall into line.

19. The present Copra Ordinance with its permissive system of grading has not had the desired effect, and to attempt to administer it in its present form in so far as its grading provisions are concerned would prove a costly and ineffective experiment. Under present circumstances the incentive to produce copra of high quality is lacking except in cases where producers make a sufficient quantity to warrant shipment under their own brand to a consumer whom they have been able to satisfy in regard to maintenance of satisfactory standards of quality of their copra. Without an established system of copra grading, purchasers of Fiji copra have to safeguard themselves against its low quality and they therefore fix the price on the basis of the worst they expect to receive. The resultant discouragement to those who would and could produce a better quality article is obvious.

20. The merchant's point of view can of course, be understood. With a system of compulsory grading of copra he would have to separate good and bad copra in his export shed, instead of mixing it as he does at present. Some trouble would be involved by the work of the Inspector who would require the withdrawal of selected bags of copra for examination. In this way a certain amount of additional handling would be necessary.

21. It is interesting to compare the attitude of local merchant firms to export produce grading with that displayed by merchant firms in other Colonies who are themselves interested not only in the actual purchase of raw produce, but in its utilisation in industry afterwards. In the case of the latter, export produce inspection is welcomed and has, in fact, been definitely pressed as a desirable means of improving standards of quality and of securing higher returns not only to the producers but to the merchant themselves. I know of no case where export produce inspection and grading has not benefited all classes of the producing and merchant communities.

22. The position in regard to copra has undergone a change during recent years. Results of scientific inquiry have been applied industrially to the needs of the edible oil and fat industries and a wider range of oils and fats can now be employed than was the case a few years ago. The effect of the competition of other oils and fats on the value of copra has been shown in a remarkable manner during the past three years and although the almost continuous fall in market prices has not been entirely occasioned by the increased employment of other oils, that has undoubtedly been a very large factor. The user of coconut oil under modern conditions would endeavour to employ the best quality product at a price which suits him and which, at

the same time, will be considerably in excess of that offered for inferior grades. He may still be prepared to purchase those inferior grades but, again at a price which suits him and at a figure which, as has been shown, is considerably below that for superior standard qualities.

23. Fiji copra has long had a bad name. Crushers have often complained about it and attempts have been made to improve the position. The copra Ordinance was originally designed to improve the quality of locally-produced copra by a system of compulsory export grading which was to be supported by the suppression of undesirable practices on the part of the copra producer. It has been shown that the Bill in its passage through Legislative Council lost its original character and that since it became law it has exercised no appreciable effect on the quality of Fiji copra. Whether the position will ever arise when inferior copra will be impossible to sell is a question that time only can answer, but events have shown that in one or two instances Fiji has been dangerously near to that state of affairs. It is reasonable to assume that the Copra Ordinance has been given a fair trial; that it has failed miserably to achieve the purpose for which it was made law; and that the time has now arrived when compulsory grading of copra should be introduced. I recommend therefore that early steps be taken to provide the necessary legislation and to establish the service required.

24. Legal power should be taken either by amendment of the existing Ordinance or by the introduction of a new Bill to empower the Governor by Proclamation to require copra exported from any port or part of the Colony to be inspected, graded and branded prior to shipment. Provision would require to be made for the appointment of Inspectors, the establishment of grades, the manner of inspection, the marking or branding of bags containing copra which had been inspected and graded, the making of regulations and penalties for breach of the Ordinance and regulations.

25. It would be desirable in the first instance to confine export copra inspection and grading to the port of Suva where the work would be under constant and close supervision. After a period, say, one year, the system could be extended to Levuka and to other points of export from the Colony. One Inspector only would be required in the first case, who would be a man of considerable experience whose appointment was approved by the London Copra Association in accordance with the recommendation of the Coconut Planters' Union Ltd. In the course of two years such a man would be able to establish the system on a satisfactory basis and to train other men who would continue the work after the conclusion of his period of engagement.

26. The cost of the service during the first two years would be about £1,700, made up of salary £700 per annum, return passages £250, and incidental expenses £50. Clerical services could be provided by the existing staff of the Agricultural Department. In the third and subsequent years the annual cost should not exceed £580—salary, say, £400 to £500 for the Inspector and Grader, and a small provision for expenses. Inspection would be carried on in exporters' sheds, while labour for the work involved would be provided by the exporter.

27. The scheme could be financed by an export tax on copra, to be administered in a manner to be decided. In this connection the scheme advanced by the Coconut Planters' Union Ltd. could be considered. A tax of 8d. per ton on all copra exported from the Colony would suffice to meet the cost of the inspection and grading service in 1932 and 1933. This would yield £833 in 1932 on an estimated output of 25,000 tons, and £1,000 in 1933 on an estimated output of 30,000 tons. In later years a tax of 4d. per ton

would be enough. A small premium above market prices for second grade copra would more than compensate producers for the cost of the service.

28. The argument will doubtless be adduced that the small premium accruing for higher grade copra will not meet the additional production costs incurred. It has been pointed out that the advantage to the producer is not so much the slightly higher market price for good quality copra, as the increased quantity that can be produced and marketed from the same amount of raw material by the practice of improved methods of preparation. This contention is supported by scientific evidence which clearly shows that incidental losses occasioned by moulds and insects are greatly reduced, with the result that returns per acre are increased and production costs thus lowered.

NOTES ON COCONUT PESTS AND NOXIOUS WEEDS IN FIJI.

By R. J. A. W. Lever, B.Sc., A.I.C.T.A., F.E.S.

During the months of March and April, 1931, the author, at the suggestion of the Director of Agriculture, made a tour to Taveuni and Lau, primarily to investigate the result of two liberations of *Apanteles tirathabæ* against the spike- or spathe-borer (*Tirathaba trichogramma*) and also to study the leaf-miner (*Promecotheca reichei*).

Tirathaba trichogramma, Meyr.—Two colonies of the Javanese Braconid *Apantelas tirathabæ* were liberated at Mua, Taveuni, by Mr. T. H. C. Taylor in 1930. The first, at the end of April, consisted of 65 males and 100 females, and the second, in mid-November, of 50 of each sex. The site chosen was a block of Malayan Dwarfs planted at 15 and 20 feet quincunx-wise. During March, 1931, the writer collected several hundred Tirathaba larvæ from trees near the original liberation and up to a distance of a quarter of a mile, including several normal tall coconut trees. Young larvæ in the first and second instars, which are the stages parasitised by the Apanteles, were reared during the following week, while a number of third and fourth instars were preserved in chloral hydrate for subsequent dissections to find the internal parasite. All the young larvæ were reared through to moths, while no parasites were found on dissection.

The explanation of the non-recovery of the parasite may be due to unfavourable weather killing off the colonies which were rather small in each case (165 and 100) or, more probably, they may have spread so widely over a large area of the island that they are present in negligible numbers near the original site.

This apparent failure of Apanteles in Taveuni contrasts with its spread in the Suva district where there has been a noticeable reduction in the numbers of Tirathaba larvæ per spathe between the beginning of January and early March.

At Vuna and other districts in the south of Taveuni there were signs of an appreciable nut-fall at the end of April but no insect was incriminated.

Promecotheca reichei, Baly, (the Coconut Leaf-miner).—Statements of the damage done by this Hispid are still often inaccurate. Thus Maulik (1) states that the larvæ live in the folds of the unopened tender leaf-buds, whereas it is not until the leaves have opened that the eggs are laid and then they do not hatch for another two and a half weeks after this. Although indigenous to Fiji this beetle is rather scarce west of Taveuni and is normally a pest only in the Lau group, where the weather is very dry. The damage

is two-fold, consisting of fine lines gnawed by the adult on the undersides of the tips of the distal leaflets, and larval mines, which may be seven inches in length, between the epidermes.

Before going to Lau the writer was most generously allowed to see an unpublished paper by Mr. T. H. C. Taylor who studied this insect for six months on Vanua Balavu. The present writer was only able to visit one estate, namely, on Munia, but unfortunately the beetles were just starting to oviposit so that there were no larvæ present during the visit. The beetle is most serious after a hurricane when the leaves have already suffered badly from wind damage. It is estimated to cause a loss of from 25 to 33⅓ per cent of the crop by weakening the trees.

Both the egg and larvæ are parasitised, the former by a Chalcid (*Chætostrictia*) and the latter by an external Elasmus, which in turn has a hyperparasitic Eulophid (*Tetrastichus sp*). The percentage parasitism of the larvæ in the January outbreak was about 15 at Munia, but no record could be obtained of the amount of secondary parasitism.

The most serious damage by the beetle is to the third and fourth youngest open leaves, the tips of the terminal pinnæ being especially eaten, giving a silver-grey colour to the leaves which is very characteristic. The beetle confines itself to a group of trees till these are badly injured, when it flies away to start another localised infestation. It is interesting to note that on one occasion an egg was found on the shiny dorsal surface of the leaf instead of as usual on the rougher lower side. It was seen that the damage had always spread from some site on the coast and the explanation seems to be the same as that advanced by Jepson (2) for Levuana, viz., that the coconut leaf-baskets consisting of leaves with some live pupæ in the mines were carried inwards from landing places by the natives.

Undoubtedly the chief controlling factor of this pest is not insect parasites but an abundant rainfall, as it is only in the very dry districts that it is of economic importance. In Taveuni this beetle occasionally does harm, but nothing comparable with that done in Lau. The rainfall for these two places during the visit was:—

	Mua, Taveuni.	*Munia, Lau.*
	Inches.	*Inches.*
December, 1929 ..	8·52	0·4
January, 1930.. ..	12·05	8·1
February, 1930 ..	28·14	12·3
March, 1930	9·1	5·9

Unfortunately the parasites are very susceptible to rain, thus nearly 37 per cent. of the *Elasmus* were found drowned in the mines at Mua. Another factor which favours the pest is wide planting of trees, as the beetle prefers sunlight and clear space rather than shade and crowding. Hence, one finds that European estates with their 30 foot planting suffer more than the overcrowded native holdings. The problem of the outbreaks is still unsettled.

For any introduced insect to establish control over *Promecotheca reichei* in Fiji it must be able to withstand drought conditions and be sufficiently oligophagous to survive between the outbreaks of the beetle.

A stick-insect (*Græffea crouani*) (2) called " mimimata " by the natives causes severe damage to the leaves, which are so eaten as to leave a deeply notched margin, or even only the midrib. This Phasmid is nocturnal, being found by day resting in the folded leaflets of the coconut trees. The female, which measures 11 cm., exclusive of the antennæ and gonapophyses, carries the male which is 8 to 9 cm. long. The resting position of both sexes is

with the first pair of legs extended more or less parallel with the body. A white fluid with an unpleasant odour is ejected backwards from a pair of prothoracic tubercles when the insect is disturbed.

The egg, which measures 6 mm. in length, 2·75 mm. in width and 2 mm. in thickness, is light brown to chocolate in colour and deeply and irregularly pitted. It has an obliquely placed mammiform lid, a crater-like hilum on one side and a keel on the opposite side, the whole, as is usual in this family, simulating a seed in appearance. The incubation period is three months.

This is often locally a very serious pest. Jepson (3) writing in 1911 states that it does considerably more damage in some places than *Levuana* which was then of paramount importance. It is found also in Samoa, and was taken by Simmonds (4) in Wallis Island and Futuna, though here there may be a different species as the synonymy is still very vague, *Lopaphus cocophagus* and *Græffea cocophaga* being also used.

It was noticed in Taveuni that the insect was most abundant where there was long grass, especially buffalo grass (*Stenataphrum americanum* (*secundatum*)) at the foot of the trees.

Grease-banding of the trunks to prevent the ascent of apterous females and nymphs, and smoking by fires lit under the trees are suggested methods of control. The introduced Australian magpie (*Gymnorhina*) and the Indian mynah (*Acridotheres tristis*) are said to be very useful in Taveuni as controlling agencies. The removal of tall grass from the plantations is to be recommended and would expose the eggs, which are showered down from the trees, to ant attack.

Blow-flies.—*Chrysomyia* (*Calliphora*) *rufifacies* and *C. megacephala* are the two blow-flies which do most harm in Fiji. On one estate in Taveuni where these flies were serious it was found that kerosene rubbed into the affected parts after shearing around the area killed the maggots and pupæ, though it caused a sore.

Rats.—Nearly all planters seem agreed that rats, and not fruit-bats (flying foxes), are the only mamalian pests. The bats (*Pteropidæ*) were seen to be feeding on male flowers which often fell down in a shower, but no damage to female nuts was noticed. Rats, *Epimys* (*Mus*) *rattus alexandrinus* and *M. norvegicus*, on the contrary may be very serious and breed in the tree-tops—one tree may sustain quite a number. In Taveuni many three-quarters grown nuts were found on the ground with rodent tooth-marks. Taylor (5) has shown that trees near a permanent supply of water do not suffer so much, pointing to lack of moisture as the main reason for the damage.

Pigeons.—These birds spread both *Clidemia hirta* and *Lantana* seed by means of their droppings, their crops are often crammed with both kinds of seeds.

Clidemia hirta.—Around Levuka this weed was noticed early in March to be very robust and thrifty. No liberation of the West Indian *Liothrips urichi* has been made on Ovalau. In Taveuni one colony has spread nearly a quarter of a mile from the original site, the insects were well established and ovipositing and the plants were wilted. On the same estate, and only a mile or two away, another colony liberated at the same time was not recovered at all. The interval between liberation and the visit was six months—September, 1930, to March, 1931. Both sites were on fairly high ground, but where the parasite was recovered there was a continous wind-break of trees. At Quacavula and Ura no traces of the insect were found. On several estates in Taveuni, Mauritius bean (*Stizolobium aterrimum*) and *Dolichos hosei* were being used with some success as smother-crops against this weed.

Psidium guayava (guava).—This has already become so serious in Taveuni that certain blocks of coconut land have had to be abandoned before it. On one estate alone more than 1,000 acres have been thus sacrificed. This plant is worse where the soil is friable than where it is clayey. Sodium chlorate spraying is considered fairly satisfactory if repeated after the shoots re-appear, but any pieces of roots which are left after attempts at eradication by digging are certain to grow up.

Lantana crocea and *Lantana camara*.—These verbenaceous weeds were seen to be very abundant at Ura, and generally along the south-west coast of Taveuni. Despite a temporary check from the Mexican Tingæid (*Teleonemia lantanæ*) introduced from Hawaii in 1928 this weed has sprung up again and was very dense and seemed to be spreading.

Stachytarpheta dichotoma (blue rat-tail).—This plant seems present everywhere throughout the Group and was growing luxuriantly at Vanua Balavu in Lau. In several instances it had passed from the herb to the shrub with a stem 1½ inch in diameter. White flowers in place of the normal blue were occasionally seen. Here again, an attempt to introduce parasites from South America would be worth a trial, perhaps concurrently with work on Psidium.

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* POSSIBILITIES OF THE COLONIAL CANNING INDUSTRY.

By Sir EDGAR JONES, K.B.E., Chairman of the Empire Canning Council.

(An intentionally provocative article, urging in particular the necessity for capital development of Colonial canning to compete in World markets, a field of vast potentialities.)

ENGLISHMEN have not been successful in the industry of agriculture at home in Great Britain. They have failed to apply modern improvements, organisation, and mechanisation to the oldest of industires. The lamentable conditions that have resulted in agriculture have had personal consequences; the young men of brains and character have entirely deserted agriculture and have turned for fame and fortune to other industries. In these, there is an atmosphere of enterprise, activity and progress: there are institutes and clubs of mining, marine, electrical and wireless engineers, but where are the institutes and clubs of agricultural engineers?

In the more academic science of soils and products there are institutions and students whose research knowledge is the finest in the world. But modern organisation and engineering development in agriculture are lacking in Great Britain.

THE CANNING INDUSTRY ABROAD.

In America and Japan, and more recently, in the Dominions, the canning industry has been found to have as remarkable an effect on the mechanisation of agriculture as the motor car has had upon transport. The enormous agricultural production of certain localities in America, otherwise similar in

* From *The Crown Colonist*, April, 1931.

condition to rural England, has been created by the machinery of canning. What the mechanisation of the canning industry can do has been more dramatically exemplified by developments in Japan than those of almost any other country.

In America, before the war, the production of tinplates was about the same as the British production, but to-day the American production is double the British production. In 1913 about 700,000 tons of tinplates were consumed in the United States. To-day that consumption is around 1,400,000 tons. About 76 per cent. of the tinplates used in the United States is used for canning foodstuffs. It is estimated that the output of canned foodstuffs in America is now worth over £200,000,000 annually.

Canada, Australia, South Africa and New Zealand have made substantial progress in the canning industry, and the indications are that there will be a large expansion of canning in those Dominions in the future.

It was owing to the failure to understand the possibilities of a canning industry and to apply this modern mechanisation to agriculture in England that plant and machines for factories were not originally manufactured in this country, and the production of cans was inadequate and inefficient. In the past four years, this has been changed with an astonishing measure of success and the mechanisation methods of the canning industry have in England been applied to fruits, vegetables, soups, mixed foods, fish and other products. As a result, substantial engineering firms are now making cans efficiently, some are manufacturing plant for making cans, and others are manufacturing plant and equipment for the canning factories.

At long last, Englishmen are awakening to the practical utility of this modern industry for the revival of agriculture at home and for its development throughout the Empire. Young men seeking a career will now include this industry as one worthy of their best efforts,

Up to the present Englishmen have been lacking in leadership in this direction in the Colonies. Americans have developed a great pineapple canning industry in American Colonies, and the Chinese have developed a similar industry in certain British Colonies, but the initiation, stimulation, and organisation of a canning industry have not been taken up by Englishmen, and they have not organised native capital and enterprise in that direction.

If the four Dominions and Great Britain are excluded, it is found that the total consumption of tinplates in the canning of food-stuffs in India and the Colonies is only about 20,000 tons per annum against the America consumption of 1,400,000 tons.

The Colonies and India have, comparatively speaking, no substantial canning industry. Those countries, however, have a population of 380,000,000 consumers, and if we add the other native populations adjoining the various parts of that Empire a total of over 800,000,000 is arrived at. This vast body of consumers eat food-stuffs like the consumers in other parts of the world. Amongst them, as in other parts of the world, there are similar problems such as gluts, shortages, seasonal crops, and marketing difficulties. These consumers also require special food-stuffs different from European food-stuffs. Very little has been done as yet to utilise the economic efficiency of the canning industry for the preservation and distribution of the special foods of this vast population, as has been done for the food-stuffs of the American and European populations.

A new era is beginning, however, and Englishmen to whom the populations of the various Colonies look for leadership will, we may hope, be henceforward starting a new mechanisation of agricultural production throughout the Empire.

POSSIBILITIES IN THE COLONIES.

There are enormous possibilities, but it is very important that developments should begin with a right understanding and on sound lines. It must always be remembered that the main function of a canning industry is to provide and preserve products for the local population. There is a great need for milk products, fish products, and poultry or meat products with beans or other vegetables amongst the native populations. In this direction, in many parts of the Empire, there is unlimited scope for the future. Factories for such local purposes do not require a large amount of capital or elaborate plant. The essential machinery for a cannery which would provide for the most modern treatments need not cost more than about £400 for a small commercial unit, and the machinery for making cans for such a unit need not cost more than about £300.

In the past, when British territories have started a canning industry, they have had to go to America for the machinery for canning and for the making of cans. They can now, for the first time, come to England for technical advice and for plant and machinery. Technical information as to the treatment of products is easily available and classes of instruction are open in England for students from the Empire. Further information can be obtained from the Empire Canning Council, 12 Whitehall, S.W.1.

At first we shall be met with statements that there is nothing useful to can for local population. Such statements can now be declared to be wrong, and if the Agricultural Departments of every Colony will make practical trials, initial assumptions of this kind will soon be disproved.

CANNING FOR THE WORLD MARKET.

There are no serious marketing problems about this side of the canning industry; when it comes to the other side, namely, the mass production of special products in a Colony for sale in England, America and Europe, then the conditions are different. There must be substantial capital and organisation to break through the competition in the organised world markets. This is where the help and leadership of Englishmen must be substantial in order successfully to place on the market such canned goods as peaches, tomatoes, pineapples and mangos, and this will require powerful commercial resources. Great things could be done in this direction if large corporations were available in England to organise the marketing end of a chain of factories in the Colonies. What Cadbury has done for cocoa, Lipton for tea, Lever for palm oil and the margarine firms for nuts, can be done for canned products of the Empire on a great and successful scale.

Even for the small producers in the Colonies, however, there are at the moment opportunities in the world markets. Canned grapefruit, figs, and dates in syrup are new to the world markets, and they are yet occupied by the American producers. There is a big opportunity for the Colonies in these newer canned products. If they delay even two years, they will find that once again they have neglected a splendid opportunity.

The importance of this matter to British and Colonial trade development cannot be over-estimated. Details of what has been done in foreign countries, and of what may be done throughout the Colonies are given in a paper read before the Royal Society of Arts in April, 1930, to which readers of this article are referred for further information.

STEAM-DRIED COPRA.

INFORMATION regarding a special shipment of copra prepared at Mua Estate, Taveuni, and dried in the new steam drier there, has been courteously furnished by the Coconut Planters' Union Limited. The shipment was handled in London by Messrs. L. M. Fischel & Co. Ltd., and specially reported upon by Loders & Nucoline Limited, one of the firms of the Unilever group. The report on the copra is as follows:—

"RMA 194 FMS PLANTATION FIJI SOUTH SEA, 171 BAGS MARK MUA/CPU EX S.S. 'SIERRA.'

We give below the report on this parcel of copra as requested in your letter of 5th inst.

Good white copra above usual standard, appearance equal to high grade, some pieces rather thin. Some green mould indicating excess moisture.

Bags packed very tight, giving approximately 180 lb weight compared with usual 154 lb/160 lb. There was no evidence of oil having been pressed on to bags due to tight packing.

The analysis as compared with average of reference samples of FMS Plantation Fiji is:—

	171 *bags.* *per cent.*	*Ref. samples.* *per cent.*
Oil content	66·0	68·4
Water	4·5	3·1
FFA	1·2	4·5

We class this copra in dust Group A and colour Group A.

We wish to draw attention to the low oil content."

Messrs. Fischel & Co. Ltd. comment on the consignment in these terms:

"You will see that the copra marked MUA/CPU 171 bags Fiji copra, is really a very good analysis; the f.f.a. is low, while the oil contents of 66 per cent. is quite good, although the Unilever draw our attention to the fact that the contents is lower than usual. We have had a small open sample of this copra in the office and must say it is really very nice quality and should command a small premium over usual Plantation, although this is not easy to obtain."

THE IMPORTANCE OF GRASS.

(From "Increased Butter-fat Production" by H. W. HERN in *The New Zealand Dairyman*, Feb. 20, 1931.)

THE grass pastures are the indispensable crop of the farm. The grass under our feet is the natural forage, the healthiest and most nutritious food for milking cows. If there was throughout the milking season an abundance of rich, succulent, short and growing grass, little else would be needed to help and maintain the increase of milk and butter-fat. The growing of supplementary forage and fodder crops to provide adequate supplementary feed for the herd has been strongly advocated by the writer; but it must be remembered that these crops are intended only to supplement, not to take the place of, our pastures. The grass of a carefully-managed pasture produces more milk than comes from any other source of food grown on the farm. The only profitable system of dairying is to maintain the pastures in the best and most productive conditions possible, and by wise management to utilise

the grass so obtained to the best possible advantage. Permanent pastures are the dominant feature of the agriculture of this country, and the character and use made of the pastures determines the stock-carrying capacity of the land. The improvement of our pastures is a matter of vital importance. Yet an inspection of the permanent pastures shows, in practice and in fact, that the majority of our grass lands are not being properly managed, are not producing the grasses and clovers that they are capable of growing, and all too frequently they contain a large percentage of inferior grasses and useless weeds.

PASTURE MANAGEMENT.

The management of our grass lands is concerned firstly, with increasing the total production of the pasture, as far as is economically possible, with plants of first-class feeding value; and, secondly, in the utilisation of this maximum grass production to the fullest extent. It is essential that feeding should be continuous, spring, summer, autumn, and winter. The winter feeding of cows plays a very important part in production. Mixed pastures are better than pure ones, where they can be successfully maintained, because they provide a mixed fodder with a varied palatibility of feed, which is preferable to a pure one for cows. The various grasses and clovers also vary in their rate of growth during different periods of the year, and as the larger number of our permanent pastures are more or less continuously grazed, it follows that continuous grazing can be satisfactorily achieved only on land where the various grasses and plants constituting the permanent pasture yield their maximum growth at various periods throughout the year. Although the laying down, preservation and management of our permanent pastures is a matter of vital importance to the dairy farmer and to the Dominion, it is a regrettable fact that the majority of our pastures are not really productive, nor are their contents anything approaching plants only of the highest feeding value. The following are some of the factors of pasture mis-management urgently needing attention:—Unsuitable mixtures sown in the first instance, neglect of necessary care in seeding, the predominance of short-living grasses in the place of more permanent ones, inferior grasses and weeds, want of proper drainage, absence of lime, want of proper management with regard to stocking, allowing the grass to get away beyond the proper length of maximum feed value, want of utilisation of excess growth as silage during period of abundance, want of manuring with the soil deficient in fertility, and top-dressing with fertilisers at the wrong time or so as not to extend the period of pasture growth during periods of shortness of growth.

Grass is now looked upon as a crop, which should not be allowed to grow beyond a height of from four to five inches, when it is rapidly fed down and then spelled to grow again. This pre-supposes three main factors of pasture management—closer subdivision, regulated stocking, and suitable top-dressing. As the majority of our dairy farms are not yet sufficiently subdivided to allow of the complete control of the pasture growth during the summer period of abundance by means of grazing, all surplus growth should be mown and conserved by ensilage for use in periods of pasture shortness. What is required in our pastures is not an abundance of grass growth, but a continuous growth of young leafy grass. The feeding value of grass has now been shown to rapidly lessen as it gets older, being long past its best at the flowering stage and containing half as much protein as it did when young and a large amount of indigestible matter. Grass in the young leafy stage is as rich as clovers in protein and is almost completely digestible by the animal. The aim of the dairy farmer should be to control the pasture

growth by careful rotational grazing and management, so that the grass is kept short and succulent, and the pastures in the best and most profitable condition of herbage in continuous growth in the young leaf stage. A more general adoption of intensive grass management cannot but result in a material increase in butter-fat production.

EFFECT OF HIGH LAND VALUES.

An important factor which has contributed to retard the better improvement of our pasture lands is the fact that too many farmers, since the war period, have shifted from one farm to another. A good many landowners were more speculators than real farmers, being more interested in the profit likely to be made on resale of the land than on the permanent improvement of their pastures and the maintenance of fertility of their land. As long as this state of affairs continued, the personal interest and enthusiasm necessary for success was lacking. The bad times, with consequent re-adjustment of land values, through which we are passing, will check this tendency It should make our farming more permanent, with the return to be obtained from the soil, on the re-establishment of the dairying industry on paying and profitable lines, of the first importance.

THE NEED FOR SUPPLEMENTARY FEEDING.

The critical pasture periods and the need for adequate supplementary feeding to maintain the maximum milk production was dealt with fully in the article entitled "Supplementary Feeding," published in the *Dairyman* for July, 1930. Although the grass is the natural food of the cows, it is becoming more evident that our dairy farmers have in the past depended too much on the grass alone, and that the feed produced by our permanent pastures should be supplemented with hay and roots in winter, and silage or grass forages in the summer and autumn, if we are to obtain the maximum milk production of which our cows are capable. It is only by making suitable preparation that a supply of feed will be available in the days of scarcity, when a sufficiency of feed is of essential importance in successful dairying.

THE IMPORTANCE OF TOP-DRESSING.

On all our dairying grass lands the most important means of increasing the production of the pastures is by adequate and suitable top-dressing. In dairying this is a most important phase of farm management, and the annual application of fertilisers should be looked upon as important as the daily milking of the cows. The outstanding feature of the manurial requirements of the soils of New Zealand is the major importance of phosphatic fertilisers. On dairying pastures lime also is required. In addition to improving the actual yield, phosphatic manures assist the growth of first-class grasses, and by improving the quality of the herbage play a most important part in the health, constitution and vigour of the stock which graze on pastures treated with lime and phosphoric acid.

The modern tendency in top-dressing pasture lands is not to apply fertilisers to increase the grass growth during the period of normal maximum growth, but rather so as to stimulate growth in the early spring, autumn, and winter. The object of top-dressing in future will be to make the pasture growth as continuous and even as possible throughout the year. It is not in times of pasture abundance that additional growth is required, but it is in times of lessened pasture production that increased herbage is of the greatest value.

THE VALUE OF BREEDING.

Breeding is a most important means of increasing the butter-fat output of our cows. Herd-testing should be universally adopted, and at the same

time farmers should realise the necessity of having pure-bred bulls at the head of their herds. The practice of keeping any kind of bull, so that the cows were put in calf, has been far too common in this country. This was particularly noticeable in the case of too high priced dairying land, where a farmer was compelled to over-stock with milking cows, so that he could not keep any heifers, and the calves were killed. If all the calves were killed it would not have mattered very much, but unfortunately many farmers kept what they regarded as their best calves, knowing full well that they were the progeny of a scrub bull. This practice has perpetuated one of the troubles of our dairying industry: the low butter-fat production of many of our milking cows.

The important thing in working up a good herd is to have a good foundation. The breeder should first choose his breed, and having selected the type he wants, keep to it. A start can be made in a small way, with a good sire and a few cows. It is much better to have a few cows of good quality than a large number of average nondescript type. Line breeding is the most successful way to establish continuity of type. It is not necessary to sacrifice type for production, and to mate the progeny of a cow of record butter-fat production with a herd of perdigee line-bred cows more often than not leads to disappointment. Many of the best performers in the Dominion semi-official test are typical of their breed and line-bred. In the Island of Jersey, importation of foreign cattle has always been forbidden, and the Jersey cattle have been bred from a type and butter-fat standpoint. By line-breeding the pedigree of a certain strain is followed right through, with preservation of type. Although it is true that half the breed goes down the throat, it is equally true to say that the bull is half the herd. In any effort to assist the re-establishment of the dairying industry by increasing the production of butter-fat, the permanent factor of improvement is a herd of higher-producing cows.

LIME IN PASTURES.

(From *The New Zealand Dairyman*, Jan. 20, 1931.)

Dr. J. B. Orr, of the Rowett Institute, dealing with the importance of minerals in the feeding of dairy cows, says:—A cow giving four gallons of milk per day secretes daily in the milk 1·0 oz. calcium, 1·3 oz. phosphorus, 0·4 oz. sodium and 0·64 oz. chlorine. These are taken from the living tissues of the animal, and unless she can absorb from the intestine sufficient to replace this loss, the tissues become depleted. In most heavy milking cows there is, during lactation, a progressive depletion of the skeleton. It has been estimated that a cow may lose as much as 20 per cent. of the mineral matter of the skeleton during a lactation period. The writer has suggested elsewhere that the depletion of the tissues of heavy milking cows may be the cause not only of decreased milk yield in subsequent lactations, but of difficulties in breeding, and an increased susceptibility to disease.

The element which presents the most difficult problem is calcium. The fodder fed, especially if it includes good hay, will contain more calcium than is secreted in the milk. Even if an abundance of calcium be provided in the food, however, there is difficulty in getting a sufficient amount absorbed from the intestine. The calcium in green food is more easily assimilated than the calcium in concentrates. It is also better assimilated from well got hay which has been little exposed to the elements after cutting than from hay which has been badly weathered.

The statements made by this authority suggest that the addition of lime to the pasture and keeping up a sufficient supply of lime at all times in the soil would increase the supply of lime in the grass and particularly in the clovers and trefoils and this would not only tend to increase the milk yield of the herd, but would be largely instrumental in preventing diseases and disorders in dairy cows and would play an important part in developing the frame of the calf. The presence of rock salt on pastures where the cows can lick it when so inclined is also valuable in maintaining the health of cows.

THE COCONUT MOTH IN FIJI.

A RECORD of the work undertaken by the Coconut Committee for the control of the Levuana Moth of coconuts in Fiji, has been published under the above title by the Imperial Bureau of Entomology. The account of this most interesting and successful campaign for the control of one of the most serious pests of coconuts in the Fiji Group has been compiled by Dr. J. D. Tothill, T. H. C. Taylor and R. W. Paine. The book (Crown quarto) comprises 265 pages of letter-press and 24 plates, the originals of many of which were prepared by H. W. Simmonds.

The record of this highly organised and relentless campaign against an enemy which bade fair to make the production of copra in Fiji unprofitable is one of absorbing interest, particularly to workers in other territories who are faced with problems concerning the biological control of serious pests.

The contents include an introduction and a historical account of previous work, followed by a general account of the campaign instituted in January, 1925. The Levuana Moth is fully described, as is also the Tachinid Fly, *Ptychomyia remota*, which was successfully introduced, bred and distributed locally. The report is supported by descriptions of allied Zygaenids and notes on their natural control, together with an account of the predacious beetle, *Callimerus arcufer*. The book is primarily one which will interest students of economic entomology and it should form a valuable acquisition to the libraries of Research Institutions which are concerned with entomology.

Copies may be obtained either from the Department of Agriculture, Fiji, or from the Imperial Bureau of Entomology, Queen's Gate, London, S.W.7, at a cost of £1 11s. 6d.

The publication was authorised by the Coconut Committee of Fiji, who bore all expenses connected therewith, and forms a valuable record of protracted investigations carried out under their direction.

SEEDS FOR DISTRIBUTION.

THE following seeds are available for distribution on application to the Department of Agriculture, Suva; or the Government Experimental Farms at Navuso, near Suva, and at Sigatoka:—

(1) Paddy Rice, variety "Sonacalif." A quick growing, early rice, seed of which can be obtained in limited quantities at 2s. 6d. per benzine tin, containing about 28 lb.

(2) Mahogany tree seeds from the West Indies:—

(*a*) *Swietenia mahogani* (West Indies mahogany).
(*b*) *Swietenia macrophylla* (British Honduras mahogany).

These can be obtained free of charge.

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